

CLAIMS

1. A gallium-nitride-based light-emitting apparatus comprising:

5 a substrate;
 a first-conducting-type clad layer formed on the substrate;
 an active layer formed on the clad layer; and
 a second-conducting-type clad layer formed on the active layer,

10 the active layer including barrier layers and well layers made of a gallium-nitride-based compound semiconductor, wherein the barrier layers of the active layer include a first barrier layer formed toward the first-conducting-type clad layer and second barrier layers sandwiched by the well layers,

15 the light-emitting apparatus comprises a second-conducting-type carrier block layer between the active layer and the second-conducting-type clad layer, and

 the band gap E_{gb} of the carrier block layer, the band gap E_{g2} of the second barrier layer, the band gap E_{g1} of the first barrier layer and the band gap E_{gc} of the clad layers satisfy the relationship $E_{gb} > E_{g2} > E_{g1} \geq E_{gc}$.

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2. A gallium-nitride-based light-emitting apparatus according to claim 1, wherein the thickness d_1 of the first barrier layer and the thickness d_2 of each of the second barrier layers satisfy the relationship $d_1 > d_2$.

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3. A gallium-nitride-based light-emitting apparatus according to claim 2, wherein the thickness d_1 of the first barrier layer

satisfies the relationship $d1 \leq 50$ nm.

4. A gallium-nitride-based light-emitting apparatus according to claim 1 or 2, wherein the thickness $d3$ of each of the well layers
5 satisfies that the relationship $d3 \leq 4$ nm.

5. A gallium-nitride-based light-emitting apparatus according to any one of claims 1 to 4, wherein the first barrier layer and the second barrier layers comprise $Al_xIn_yGa_{1-x-y}N$ ($0 \leq x \leq 0.3$ and
10 $0 \leq y \leq 0.05$), and wherein the well layers comprise $Al_aIn_bGa_{1-a-b}N$ ($0 \leq a \leq 0.01$ and $0 \leq b \leq 0.1$).

6. A gallium-nitride-based light-emitting apparatus according to any one of claims 1 to 5, wherein the carrier block layer comprises
15 $Al_pIn_qGa_{1-p-q}N$ ($0 \leq p \leq 0.5$ and $0 \leq q \leq 0.1$).

7. A gallium-nitride-based light-emitting apparatus according to any one of claims 1 to 6, wherein the clad layers comprise a super-lattice structure formed by stacking layers of $Al_\alpha In_\gamma Ga_{1-\alpha-\gamma}N$ ($0 \leq \alpha \leq 0.2$ and $0 \leq \gamma \leq 0.1$) and layers of $Al_\beta In_\eta Ga_{1-\beta-\eta}N$ ($0 \leq \beta \leq 0.05$ and $0 \leq \eta \leq 0.1$).
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